Reconsideration of Steam Electric Effluent Limitations Guidelines (ELGs)

Overview of Wastestream-Specific Petition Issues

May 23, 2017

Reconsideration Briefings

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Background on Effluent Limitations Guidelines and Standards (ELGs)

- The Clean Water Act directs EPA to establish ELGs to control discharges of pollutants in industrial wastewater to surface waters and publicly owned treatment works (POTWs)
- ELGs are based on the performance of specified technologies; facilities are not required to use those technologies and may instead use alternative technologies/approaches to comply
  - Statute designed to increasingly elevate the technology floor for all dischargers in an industrial sector to match the performance of the best plants in the industry
  - Not based on the water quality of individual receiving waters
- ELGs provide equity and certainty for industrial facilities as the requirements apply nationally

Background on the Steam Electric ELGs

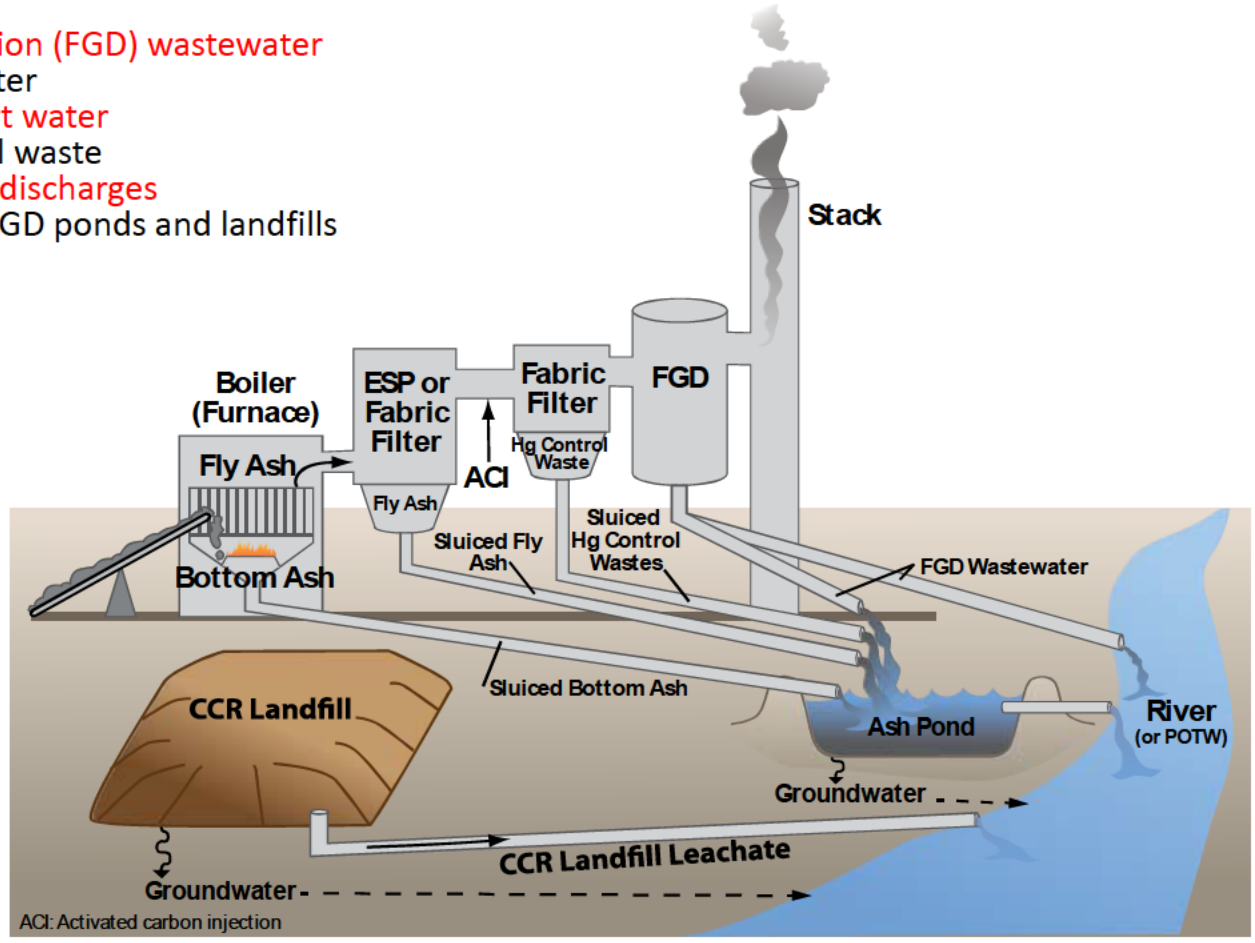
- The Steam Electric ELGs are applicable to discharges from fossil- and nuclear-fueled steam electric generating units at establishments where the generation of electricity is the predominant source of revenue or principle reason for operation
- The 2015 Rule addresses changes in the industry that have occurred since EPA last updated existing regulations 35 years ago and limits the amount of toxic metals (e.g., mercury, arsenic, selenium, lead), as well as nutrients, discharged into waterways
- The 2015 ELG Rule is based on technologies, which are already in use in the industry, are effective for treating or eliminating toxic pollutant and nutrient discharges to surface waters, (b) (5) [redacted]
- Estimated annual compliance costs and benefits for the final rule are $480 million (only 12% of industry incurs cost) and $451 to $566 million, respectively; these costs reflect the fact that many companies were already planning to retire their coal-fired units/plants because of the low cost of natural gas

Background on the Steam Electric ELG: What Does this Rule Accomplish?

- (b) (5) [redacted]:
  - Considered a range of options [redacted]
  - Special provisions for small units (<50 MW) minimize the impacts on small businesses
  - Exempted oil-fired units to maintain an energy-diverse fleet
  - Delayed compliance dates to give time and certainty to industry and lower costs
- **Human health and environmental protection**
  - Steam electric power plants are the largest industrial source of toxic pollutants discharged to surface waters, responsible for approximately 30% of the nationwide total
  - Annually reduces pollutant discharges by 1.4 billion pounds and water withdrawals by 57 billion gallons leading to improvements in public health and ecological impacts
  - Reduces severe health and environmental problems that the pollutants can cause in the form of cancer and non-cancer risks in humans, lowered IQ among children, and deformities and reproductive harm in fish and wildlife
  - Improves protections for downstream drinking water plants and their customers
  - Reduces discharges of nutrients which exacerbate over-enrichment and associated water quality problems
  - Reduces the risk of catastrophic failure of surface impoundments
  - Due to their close proximity to these discharges and relatively high consumption of fish, some minority and low-income communities have greater exposure to, and are therefore at greater risk from, pollutants in steam electric power plant discharges

Wastestreams Addressed by the Rule

- Flue gas desulfurization (FGD) wastewater
- Fly ash transport water
- Bottom ash transport water
- Mercury (Hg) control waste
- Gasification process discharges
- Leachate from ash/FGD ponds and landfills



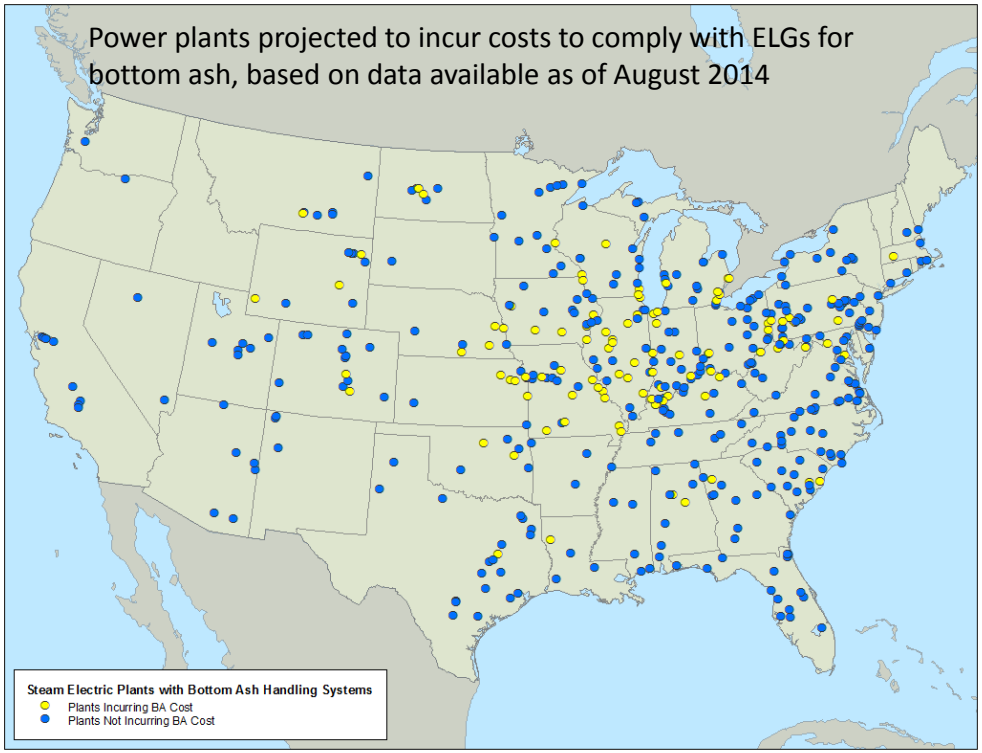
Briefing Focus: Wastestreams Raised in Petitions

- Wastestreams raised in petitions:
  - Bottom ash transport water, FGD wastewater, and gasification wastewater
- Other wastestreams not raised in the petitions (to be discussed in subsequent briefings)
  - Fly ash wastestream
    - BAT limit = zero discharge of pollutants based on converting wet ash handling systems to dry handling systems
    - At the time of the rulemaking, dry fly ash handling was widely demonstrated with more than 80 percent of generating units operating these systems and additional conversions were underway
    - Not a litigation issue
  - Combustion residual leachate from landfills & surface impoundments
    - BAT limits = limits for TSS based on settling (equal to existing BPT limits)
    - Litigation issue
  - Flue gas mercury control wastewater
    - BAT limits = zero discharge of pollutants based on dry handling systems (often collected and handled in the same way as fly ash)
    - Not a litigation issue

Bottom Ash Transport Water

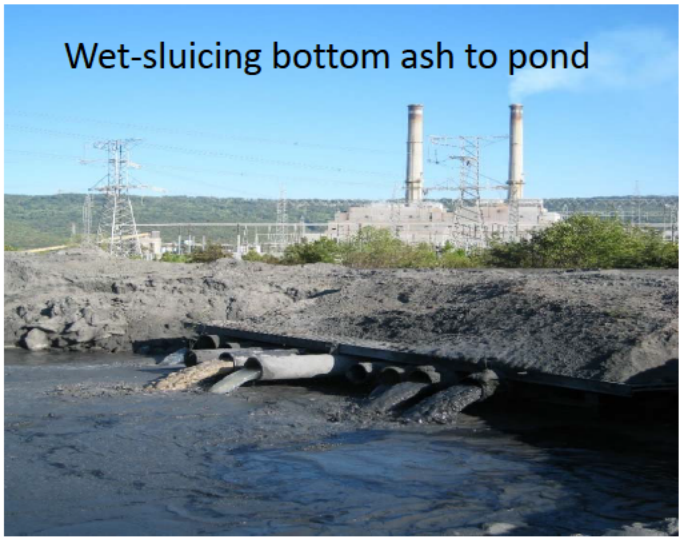
- Bottom ash consists of heavier ash particles that are not entrained in the flue gas and fall to the bottom of the furnace
  - Wastewater is generated when plants use water to transport (sluice) the ash to a surface impoundment
- 2015 BAT: Dry ash handling system or creating a closed-loop process that recycles the ash wastewater
  - When the rule was signed in September 2015, more than 50% of plants already employed zero discharge technologies or had announced plans to switch to such system in the near future
  - Following promulgation -- EPA identified that 38 of the 103 plants expected to incur compliance costs have already converted or are planning to convert to dry/zero discharge bottom ash handling systems, or are retiring/repowering generating units that would have needed to convert their ash system

Geographic Distribution of BAT Technology for Bottom Ash



Power companies have been moving (b) (5) to convert ash handling systems since promulgation of the ELGs, and to adjust business operations in reaction to market conditions (e.g., natural gas prices, customer demands for electricity from renewable energy sources). 38 (approx. ⅓) of the plants shown on the map as incurring costs have already moved forward to install the BAT technology or will retire/repower generating units.

Conversion to dry technologies



Completely-dry bottom ash silo

Bottom Ash Transport Water (Continued)

- BAT Limit: zero discharge
- BAT Pollutant Removal: Since the technology basis is zero discharge, this equates to 100% percent removal of all pollutants
- The BAT technology eliminates 44 billion gallons of bottom ash wastewater annually, preventing mercury, arsenic, and other toxic pollutants from being sent to POTWs or discharged to rivers

Bottom Ash Transport Water – Petition Issues and Considerations

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Bottom Ash Transport Water – Recommended Reconsideration Approach

Gasification Wastewater

- Integrated Gasification Combined Cycle (IGCC) plants use coal or petroleum coke feedstock and subject it to high temperature and pressure to produce a synthetic gas (syngas), which is used as the fuel for a combined cycle generating unit
- After the syngas is produced, it undergoes cleaning prior to combustion which is the main source of gasification wastewater
- 2015 BAT: evaporation
  - All U.S. operating IGCC plants (3 plants), as well as a recently retired IGCC plant, employ evaporation
  - Two of the three plants achieve zero discharge with this technology
- BAT effluent limits: mercury, arsenic, selenium, and TDS
- BAT Effectiveness: 97% median removal of regulated pollutants

Gasification Wastewater
Petition Issues and Considerations

Gasification Water – Recommended Reconsideration Approach

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Flue Gas Desulfurization (FGD) Wastewater

- FGD systems are used to remove sulfur dioxide from the flue gas so that it is not emitted into the air (scrubbers)
  - Not all plants have FGD systems, and of those that do, not all discharge wastewater (some systems are “dry” rather than “wet,” and some wet systems are operated without discharging)
- 2015 BAT: Chemical precipitation plus biological treatment
  - When the rule was signed in September 2015, nearly half of all power plants with wet scrubbers already had equipment/processes in place that would enable them to meet the new effluent limits based on chemical precipitation plus biological treatment
    - Biological treatment had been tested at power plants for more than ten years, and full-scale systems have been operating at a subset of plants for nine years
    - Other plants already able to meet the ELG limits use waste management approaches that achieve zero discharge and/or technologies that are more effective on a broader range of pollutants (*e.g.,* evaporation which removes bromide, a concern for drinking water plant intakes downstream from power plant discharges)
    - Chemical precipitation removes a portion of the pollutants in FGD wastewater; biological treatment additionally removes nutrients and selenium (a pollutant with documented severe ecological impacts), as well as more than 90 percent of the mercury and arsenic not removed by chemical precipitation

Flue Gas Desulfurization (FGD) Wastewater (Continued)

- At the time of the rulemaking, EPA estimated that 69 plants out of approximately 450 coal-fired plants (15 percent) would incur compliance costs for FGD wastewater
- Following promulgation, EPA has identified more than ten power plants that are moving forward with installing the FGD BAT technology or going further to install evaporation technologies
- BAT Effluent Limits: Arsenic, mercury, selenium and nitrate/nitrite
- BAT Pollutant Removals: 98 percent removal of the regulated pollutants

FGD Wastewater – Petition Issues

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[redacted]

FGD Wastewater – Considerations

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FGD Wastewater – Recommended Reconsideration Approach

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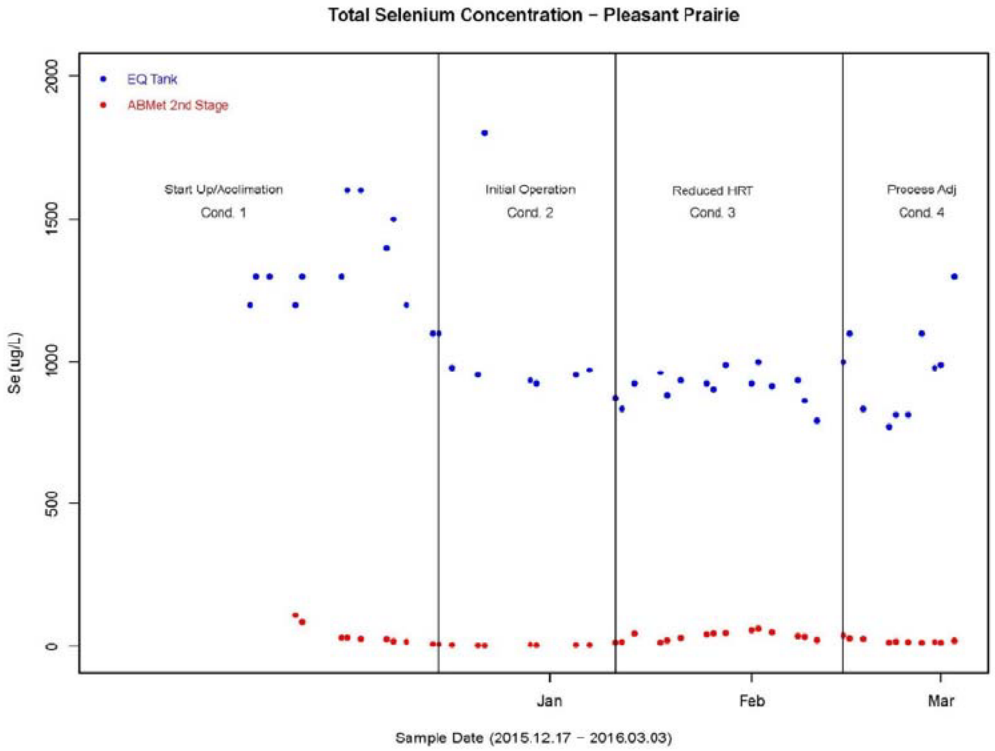
Biological Treatment at Plant Burning Subbituminous Coal

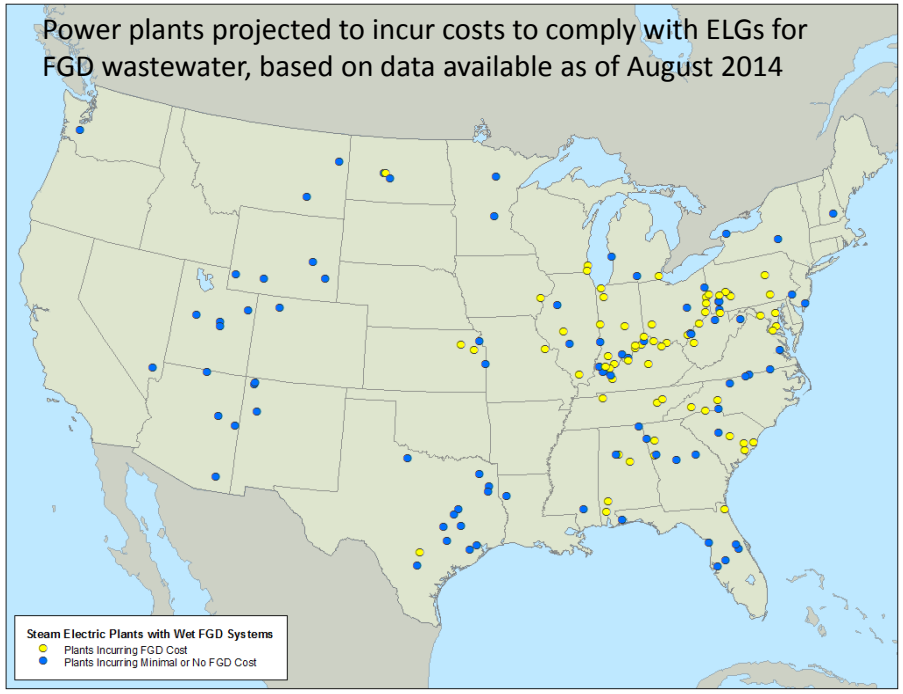
Influent vs Bioreactor Effluent

(Source: EPRI report submitted with UWAG Petition for Reconsideration)



Summary Statistics for Selenium (µg/L) – Pleasant Prairie Power Plant (Conditions 2/3/4)				
N	Minimum	Mean	Median	Maximum
32	3.4	24.6	19.5	62

Geographic Distribution of BAT Technology for FGD



More than 10 of the plants shown on the map as incurring costs have already installed, or are taking steps to install, the BAT technology (biological treatment) or more advanced technology (evaporation or solidification) that can completely eliminate the FGD wastewater discharge.

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- New variations of biological treatment
  - Fluidized bed and packed bed systems
  - Fixed-film and suspended growth bioreactors
  - Membrane bioreactors
- Non-biological adsorption using reactive media (e.g., zero-valent iron)
- New variations of thermal treatment technologies
  - Traditional and vacuum-enhanced evaporation/crystallization
  - Evaporation combined with solidification processes
  - Evaporation driven by flue gas waste heat

Appendix

Technology-Based Requirements

- 1972 Act adopted technology-forcing, increasingly stringent approach to water pollution control
- Statute designed to elevate the "base level" for all existing dischargers in an industrial sector to match the performance of the best plants in the industry
  - BPT = "best practicable control technology current available"
  - BAT = "best available technology economically achievable"

Legal Background

Overview

- 1972 Act adopted a technology-forcing, two step approach
  - BPT =“best practicable control technology currently available”
  - BAT = “best available technology economically “achievable”

Factors for BPT and BAT

- Common statutory factors for BPT and BAT
  - Age, process employed, engineering aspects, process changes, non-water quality environmental impacts (including energy requirements), other factors the Administrator deems appropriate.
- Difference:
  - BPT - "total cost of . . . technology **in relation to the effluent reduction benefits**" (Supreme Court: whether effluent reduction is "wholly out of proportion to benefits.")
  - BAT - "the **costs** of achieving such effluent reduction"
- EPA has broad discretion in considering factors and weight to be accorded each factor.

Statutory Language for BAT

- Definition:
  - "best available technology economically achievable which will result in reasonable further progress toward the national goal of eliminating the discharge of all pollutants . . . which . . . shall require the elimination of discharges of all pollutants if the Administrator finds such elimination is technologically and economically available . . . ." CWA 301(b)(2)(B).
- (b) (5) [redacted]

Judicial Interpretation of Technological Availability

- (b) (5) [redacted]

Judicial Interpretation of Cost Factor

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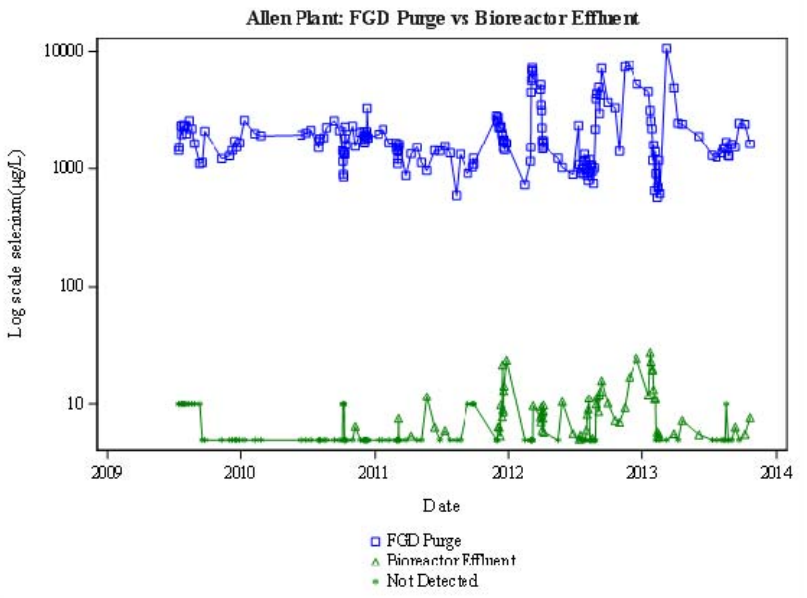
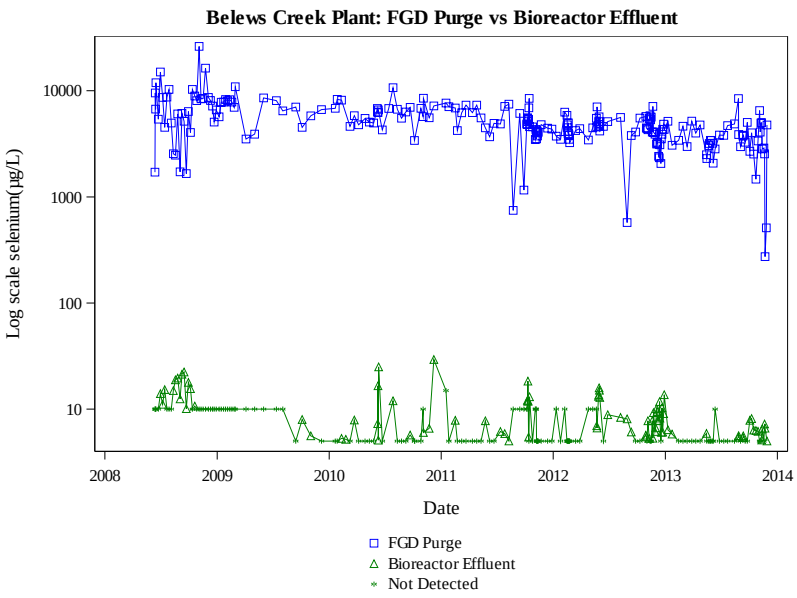
FGD Selenium Limit Data

Biological Treatment at Plants Burning Bituminous Coal

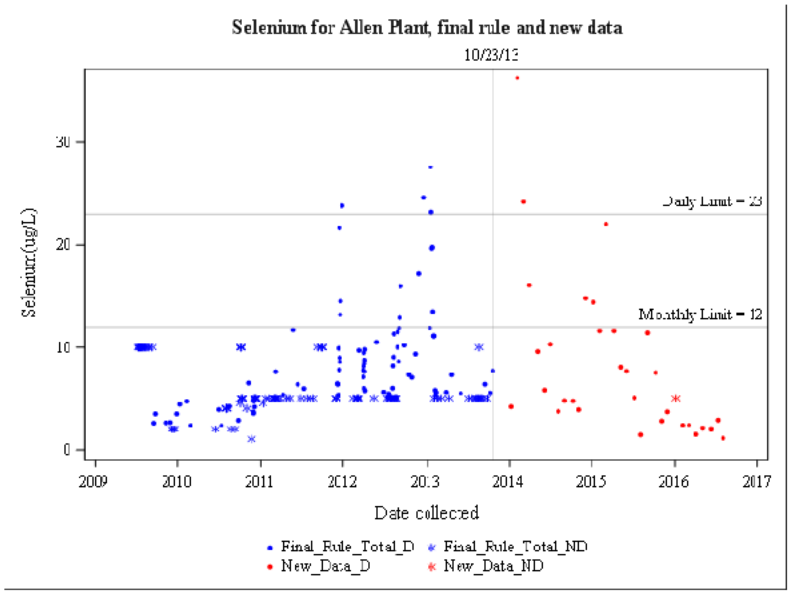
FGD Purge vs Bioreactor Effluent

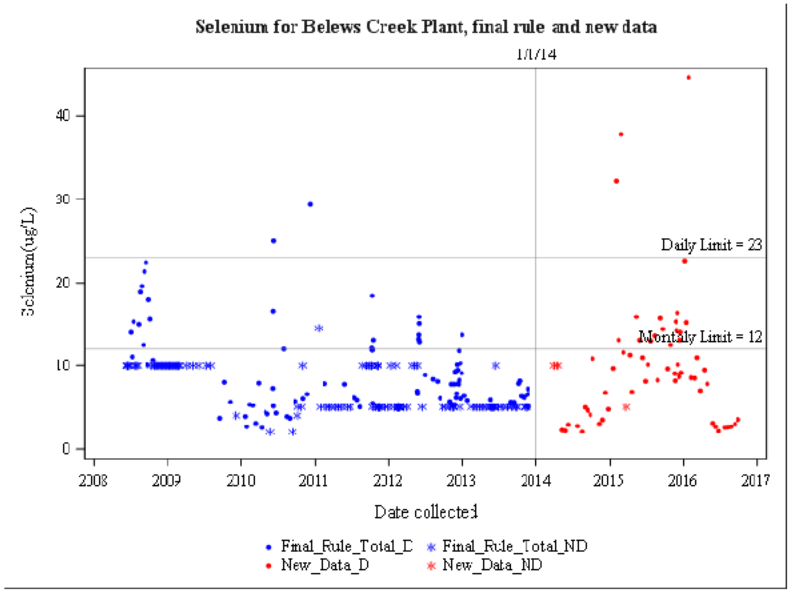




Biological Treatment at Plants Burning Bituminous Coal

Comparison of new data to the data used to calculate the ELG limits





	Summary Statistics for Selenium (µg/L) – Allen Plant				
	N	Minimum	Mean	Median	Maximum
Final Rule data	182	1	7.1	5	27.6
New data	34	1.1	8	4.9	36.3

	Summary Statistics for Selenium (µg/L) – Belews Creek Plant				
	N	Minimum	Mean	Median	Maximum
Final Rule data	216	2	7.9	6.2	29.4
New data	64	2.1	10	9.1	44.7